3 The Watersheds of the Borderlands

3.1 Watershed Basins

The U.S.-Mexico border area is located within seven major surface watershed basins stretching from the Pacific Ocean to the Gulf of Mexico. Each, with one exception is a major water body and they are called the Pacific Coastal, New River, Gulf of California Coastal, Colorado River, Northwest Chihuahua, Rio Grande, and Gulf of Mexico Coastal Basins. From the water environment perspective, each basin is uniquely defined by its geography, hydrology, water quality, public health and existing water and wastewater infrastructure. A U.S.-Mexico Watershed Basins Map is shown on Fig. 3-2.

3.2 Population of the Borderlands

Communities within a watershed basin are interdependent, with the condition of the waters leaving one community potentially affecting the water supply of its neighbor. While the water protection standards set by the two governments for their communities may differ in their form, considerable work has been done by the regulatory agencies to make them complementary in their effect. The total border population is about 12.6 million and is expected to increase to about 21 million in the next two decades, based on estimates presented below. Fig 3-1 shows the population distribution by basin. Growth along the U.S.-Mexico border has increased concerns for environmental and public health issues, including the ability to provide water and wastewater infrastructure for its residents and visitors.

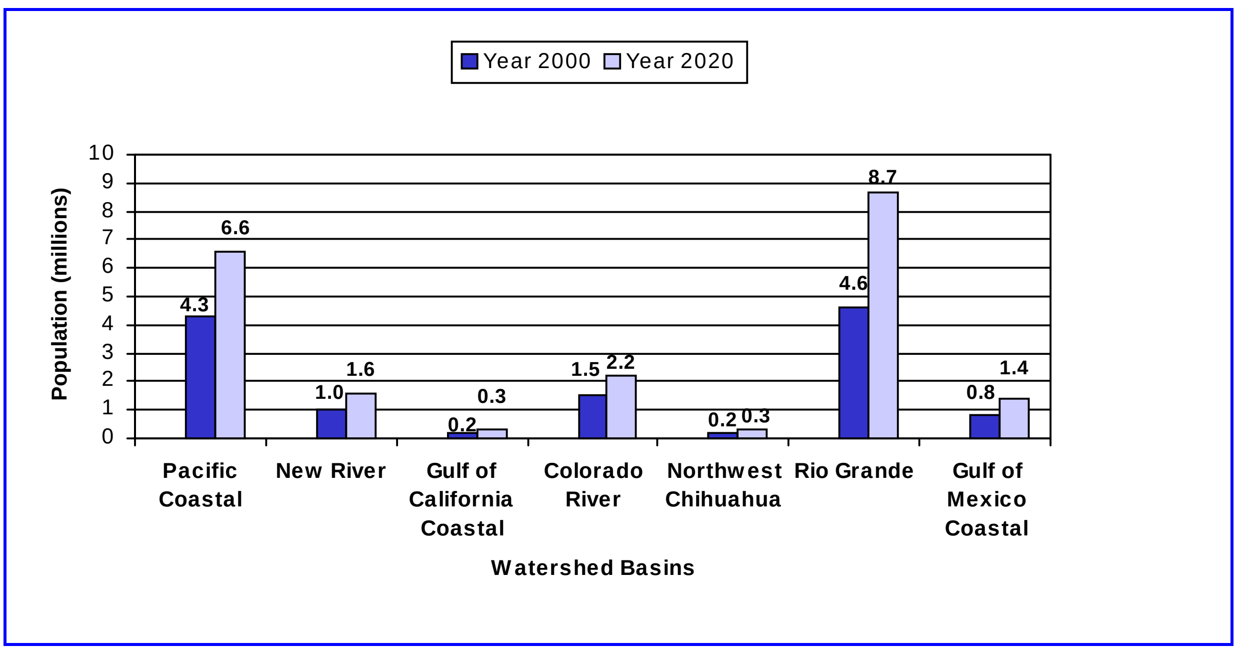

Figure 3-1. U.S-Mexico Border Population by Basin.

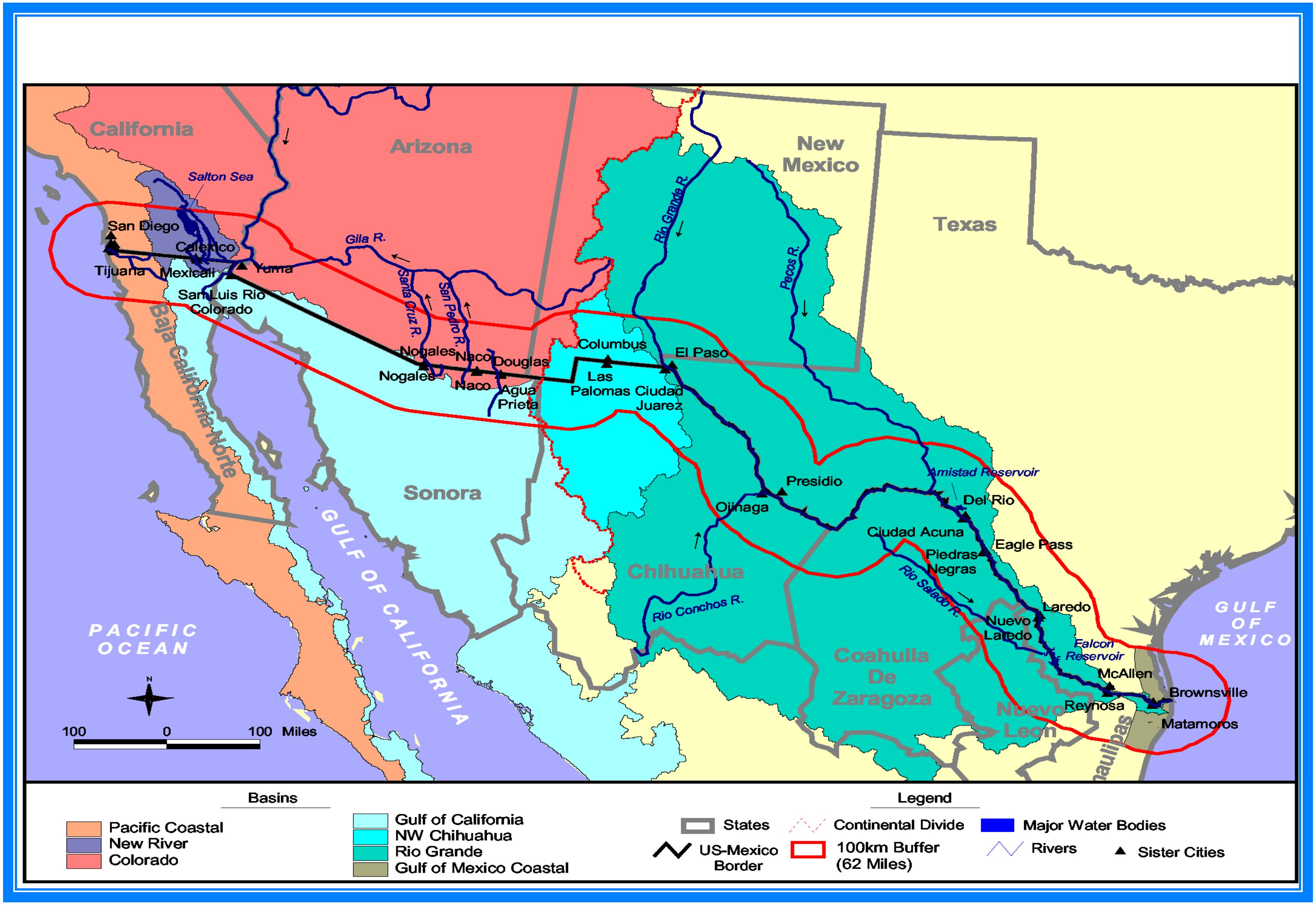

Figure 3-2. U.S.-Mexico Watershed Basins Map.

3.3 Pacific Coastal Basin

3.3.1 Geography

The Pacific Coastal Basin is located along the western coast of California and Baja California. More than 4 million people live here, primarily in the sister cities of San Diego and Tijuana. The basin, which is about 50 miles (80km) wide, extends from Lake Elsinore in Riverside County, California to the city of Ensenada, Baja California and includes the Peninsula and Sierra Juárez mountain ranges. A satellite image of this portion of the border area is shown in Fig.3-3.

FIGURE 3-3. Satellite Image of partial US-Mexico border looking east of the Pacific Coastal Basin. Gulf of California shown center right .

3.3.2 Hydrology

The Pacific Coastal Basin drains approximately 7,650 square miles (19,800 sq. km), with about half of the drainage area in California and half in Baja California.

The basin has a very dry, semiarid climate with few fresh water sources. Flow in this basin is primarily from east to west, with stream flows originating from precipitation in the mountains flowing toward the Pacific Ocean. The flow in these streams is controlled through a series of hydraulic structures, including reservoirs. Most of these streams are not perennial because of severe drought conditions in the area. The Tijuana River, which drains 1,275 square miles of the basin, is one of the main streams in the basin and one of the City of Tijuana's major natural resources. The river flows northwest through the city of Tijuana before crossing into California near San Ysidro and then flowing into the Pacific Ocean.

3.3.3 Water Quality

One major water quality concern in the Pacific Coastal Basin focuses on fecal coliform and dissolved oxygen levels. Water quality monitoring stations for the Pacific Coastal Basin has been established along the Pacific Coast from Punta Bandera or near the San Antonio de los Buenos wastewater treatment plant outfall north to Carnation Street/Camp Surf at Imperial Beach and at the ocean outfall to the South Bay International Wastewater Treatment Plant (SBIWTP). Start-up of the SBIWTP with advanced primary treatment and discharge has decreased concentrations of fecal coliform bacteria in the Pacific Ocean as indicated in Fig. 3-4. Table 3-1 [Figure 3-5] shows that for receiving waters monitoring in the Pacific Coastal Basin, fecal coliform measurements along the shore remain extremely high, with concentrations consistently exceeding 200 colonies/100 ml. The IBWC and the State of California in its National Water Quality Inventory Section 305(b) Report and the City of San Diego have identified fecal coliform as a concern in the Tijuana River, indicating that more work needs to be done to control unregulated discharges to the river. Conditions at several of the water quality monitoring locations shown, exceed U.S. surface water quality standards.
Another water quality concern in the Pacific Coastal Basin results from soil erosion and sedimentation due to increases in population growth, urbanization, and unregulated development. Due to these conditions, the estuaries and wetlands have been reduced from 20 to 40 percent of their original area. The Tijuana River National Estuarine Research Reserve is the most important estuary in the Pacific Coastal Basin, and an erosion control program has been implemented to ameliorate these problems.

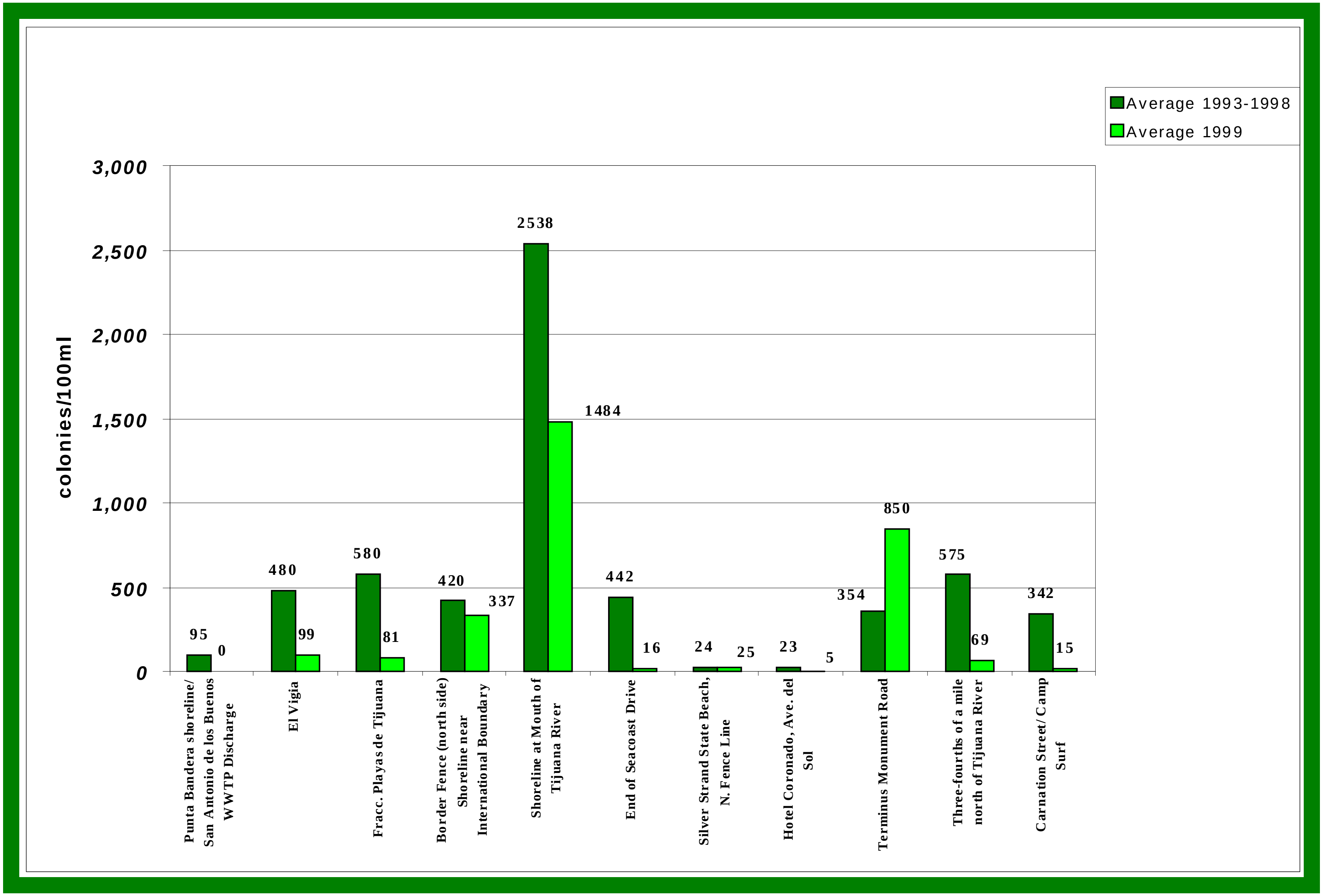

Figure 3-4. Average Fecal Coliform Concentration Before and After Start-Up of the International Wastewater Treatment Plant and Ocean Outfall.

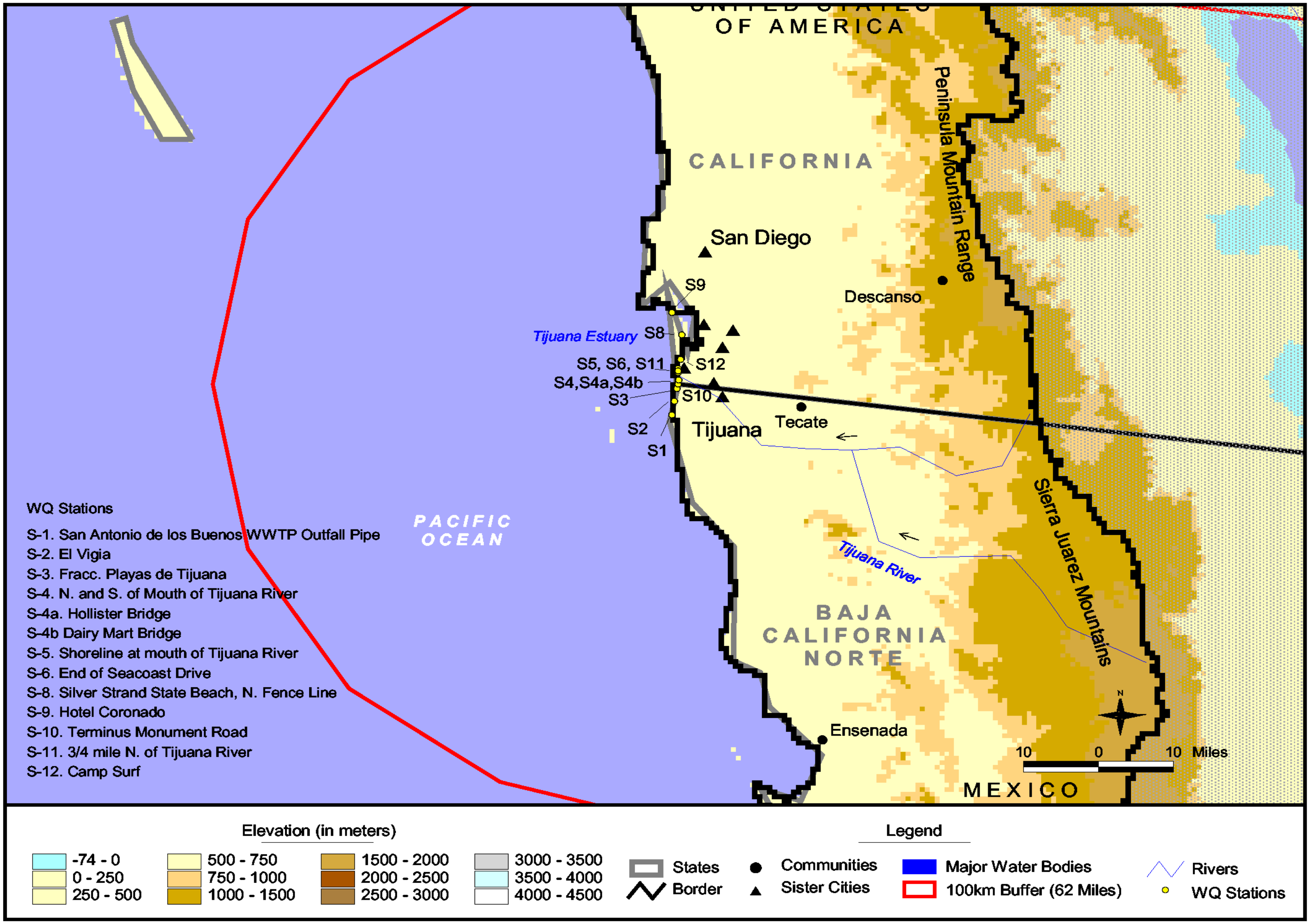

Figure 3-5. Pacific Coastal Basin with Water Quality Monitoring Stations

Table 3-1 Comparison of Surface Water Quality Standards with Sampling Data for the Pacific Coastal Basin.

Sampling Station Number	Water Quality Monitoring Locations	U.S. Standards		Sampling Data		
		Fecal Coliform Colonies /100ml	**Dissolved Oxygen mg/l**	**Fecal Coliform Colonies/ 100ml Geometric Averages**	**Dissolved Oxygen mg/l Geometric Averages**	**Reporting Agency and Time Frame**
S-1	San Antonio de los Buenos WWTP Outfall Pipe, MX	200	6. 0	96	No Data Available	IBWC 93-98
S-2	El Vigia, MX	200	6. 0	363	No Data Available	IBWC 93-98
S-3	Fracc. Playas de Tijuana, MX	200	6. 0	427	No Data Available	IBWC 93-98
S-4	North And South of Mouth of Tijuana River	200	6. 0	462	No Data Available	IBWC 93-98
S-5	Shoreline at mouth of Tijuana River,U.S.	200	6. 0	2319	No Data Available	IBWC 93-98
S-6	End of Seacoast Dr, U.S. side	200	6. 0	354	No Data Available	IBWC 93-98
S-7	Hollister Bridge, U.S. side	200	6. 0	440	No Data Available	San Diego 99-00
S-7a	Dairy Mart Bridge, U.S. side	200	6. 0	670	No Data Available	San Diego 99-00
S-8	Silver Strand State Beach, N. Fence Line	200	6. 0	25	No Data Available	IBWC 93-98
S-9	Hotel Coronado, U.S. side	200	6. 0	21	No Data Available	IBWC 93-98
S-10	Terminus Monument Road	200	6. 0	469	No Data Available	IBWC 93-98
S-11	3/4 mile north of Tijuana River	200	6. 0	471	No Data Available	IBWC 93-98
S-12	Camp Surf, U.S. side	200	6. 0	275	No Data Available	IBWC 93-98

3.3.4 Public Health Conditions

The health data presented in Table 3-2 are for the four major waterborne diseases which have a direct relation to the surface water quality. The analyzed periods are from 1988-1998 because these are the periods which represent increases and decreases which relates to the building of infrastructure facilities along the border.

Tijuana's disease rates are higher than in San Diego County; however, Tijuana's disease rates were lower than those of most other Mexican border communities, as indicated in Table 2-1.

Table 3-2. Reported Waterborne Diseases in the Pacific Coastal Basin (Incidences per 100,000 People)

Pacific Coastal Basin	Amebiasis			Hepatitis A			Shigellosis			Typhoid Fever		
	1988	1998	% Chg.	1988	1998	% Chg.	1988	1998	% Chg	1988	1998	% Chg.
U.S. Counties San Diego County	1.4	1	-29	24.3	15.8	-35	25.3	10.1	-60	0	0.3	----
Mexico Cities Tijuana	639.4	4875	662	43.9	113	157	11.0	107	873	10.5	36.0	243

Reference: Pan American Health Organization
website http://www.fep.paho.org/healthprofiles

3.3.5 Existing Water and Wastewater Infrastructure

Descanso, California. Water supply is provided from wells with a high iron and manganese content through an aging water distribution system. The community wastewater is currently treated by individual septic tanks.

Ensenada, Baja California. Water supply is provided from a surface impoundment and wells. The water distribution system covers over 98 percent of the city. Wastewater is collected from about 79 percent of the city and is treated by a 20 mgd oxidation ditch (EPA has not funded infrastructure in Ensenada).

San Diego, California. Water supply is obtained from the Colorado River and some independent wells which serve the entire county. Wastewater is collected and treated from most of the city and county by the Metropolitan Wastewater Department, with some jurisdictions providing for their own collection. The City treats its wastewater in its 140 mgd Point Loma advanced primary wastewater treatment plant with ocean discharge. San Diego is currently constructing additional wastewater treatment capacity. A water reclamation plant has been completed for the North City area.

Tecate, Baja California. Water supply is obtained from the Colorado River and local wells, serving about 95 percent of the city. Wastewater is collected from about 84 percent of the city and treated by trickling filters. The needs of the adjacent small community of Tecate, California are not known.

Tijuana, Baja California. Water supply is from a surface impoundment on the Tijuana River, augmented through an aqueduct from the Colorado River, and serves the entire city. Wastewater is collected from over 60 percent of the city and is treated at either the southerly San Antonio de los Buenos wastewater treatment plant or at the new South Bay International Wastewater Treatment Plant (SBIWTP) in the Tijuana River Valley, both with ocean discharge. The latter was funded in large part by EPA and the Mexican government. The SBIWTP and ocean outfall are shown on Figures 3-6, 3-7, 3-8, and 3-9. The SBIWTP is currently operating at the advanced primary level. The San Antonio plant and its influent pumping station are currently being rehabilitated with construction of a second influent pumping station underway, which was also funded by EPA.

FIGURE 3-6. Completed Advanced Primary Wastewater Treatment Plant (IWTP) in San Diego, California

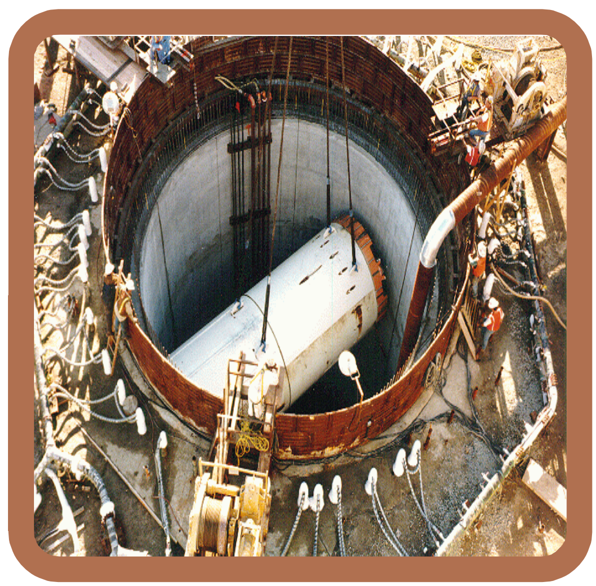

FIGURE 3-7. Construction of Ocean Outfall.

Figure 3-8. Installation of the 12 Foot Diameter Outfall for IWTP.

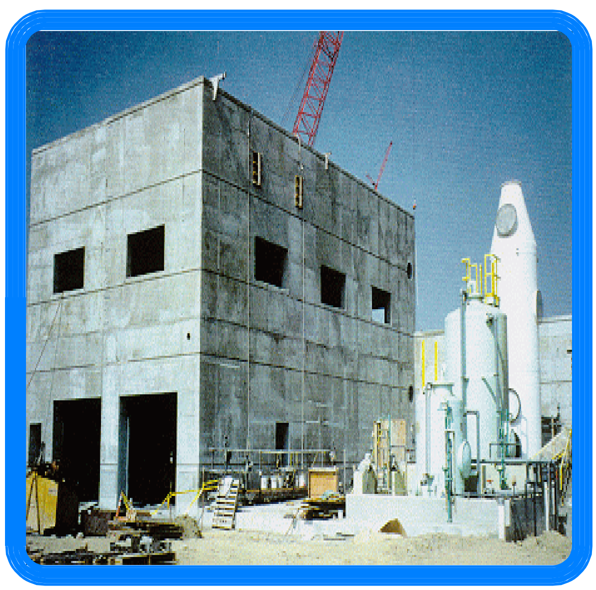

Figure 3-9 Construction of headworks and odor control building at the International Wastewater Treatment Plant.

3.4 New River Basin

3.4.1 Geography

The New River Basin extends north from the northeast section of Baja California to southeastern California, an area of approximately 7,500 square miles (19,425 sq. km). The basin is enclosed by the Chocolate and Santa Rosa mountain ranges that separate it from the Colorado River and Pacific Coastal Basins located to the east and the west, respectively. At the center of the basin is the flat, fertile Imperial/Mexicali Valley which contains the region's agricultural communities. There are several urban areas in the basin including the sister cities of Mexicali, Baja California, and Calexico, California. A satellite image in Figure 3-10 shows the New River Basin including the Imperial / Mexicali Valley with the Salton Sea in the foreground..

Figure 3-10. Satellite image looking south showing the New River Basin with the Salton Sea.

3.4.2 Hydrology

The primary water bodies in the New River Basin are the New and Alamo Rivers, which flow north from Mexico into a highly saline water body over 200 feet below sea level known as the Salton Sea. The Salton Sea was created in 1905 when the Colorado River breached an irrigation canal during severe floods and filled a natural depression between the Imperial and Coachella Valleys. The New River receives most of its flow in the U.S. from the All American Canal and in Mexico from the Alamo Canal. Figure 3-11 shows the Salton Sea at low water stage.

FIGURE 3-11. Salton Sea.

3.4.3 Water Quality

Currently, the New River is considered to be the most polluted water course in the United States. Since 1985, water quality samples have indicated water quality problems in the basin. The 1999 State of California National Water Quality Inventory Section 305(b) report identifies bacteria and sedimentation/siltation as two water quality concerns in the New River Basin.

High levels of fecal coliform bacteria indicate contamination by sewage. The current California water quality criterion for fecal coliform bacteria is 200 colonies/100 ml for waters used for contact recreation such as swimming or bathing. Fecal coliform concentrations are several orders of magnitude greater than this limit and average almost 461,665 colonies per 100 ml in the New River at the Border. Table 3-3 Figure 3-12 and contains sampling stations and data and applicable water quality criteria for various locations on the New River.

Table 3-3. Comparison of Surface Water Quality Standards with Sampling Data for the New River Basin.

Station Number	Water Quality Monitoring Stations	U.S. Standards		Sampling Data		
		Fecal Coliform Colonies /100ml	Dissolved Oxygen mg/l	Fecal Coliform Colonies /100ml Geometric Average	Dissolved Oxygen mg/l Geometric Average	Reporting Agency and Time Frame
1	Alamo River at Delta into Salton Sea	200	5.0	No Data	No Data	EPA
2	New River at outlet (into Salton Sea) near Westmorland, CA	200	5.0	No Data	No Data	USGS
3	Alamo River at Int. Border near Calipatria, Ca	200	5.0	35	5.8	USGS/CRWQCB 88-97
4	New River upstream of Discharge Canal at Mexicali	*30,000	No Data	461,665	No Data	IBWC 88-97 *Minute 264 US-Mexican 1944 Water Treaty.
5	New River at International Border	No Data	5.0	No Data	2.6	IBWC 88-97

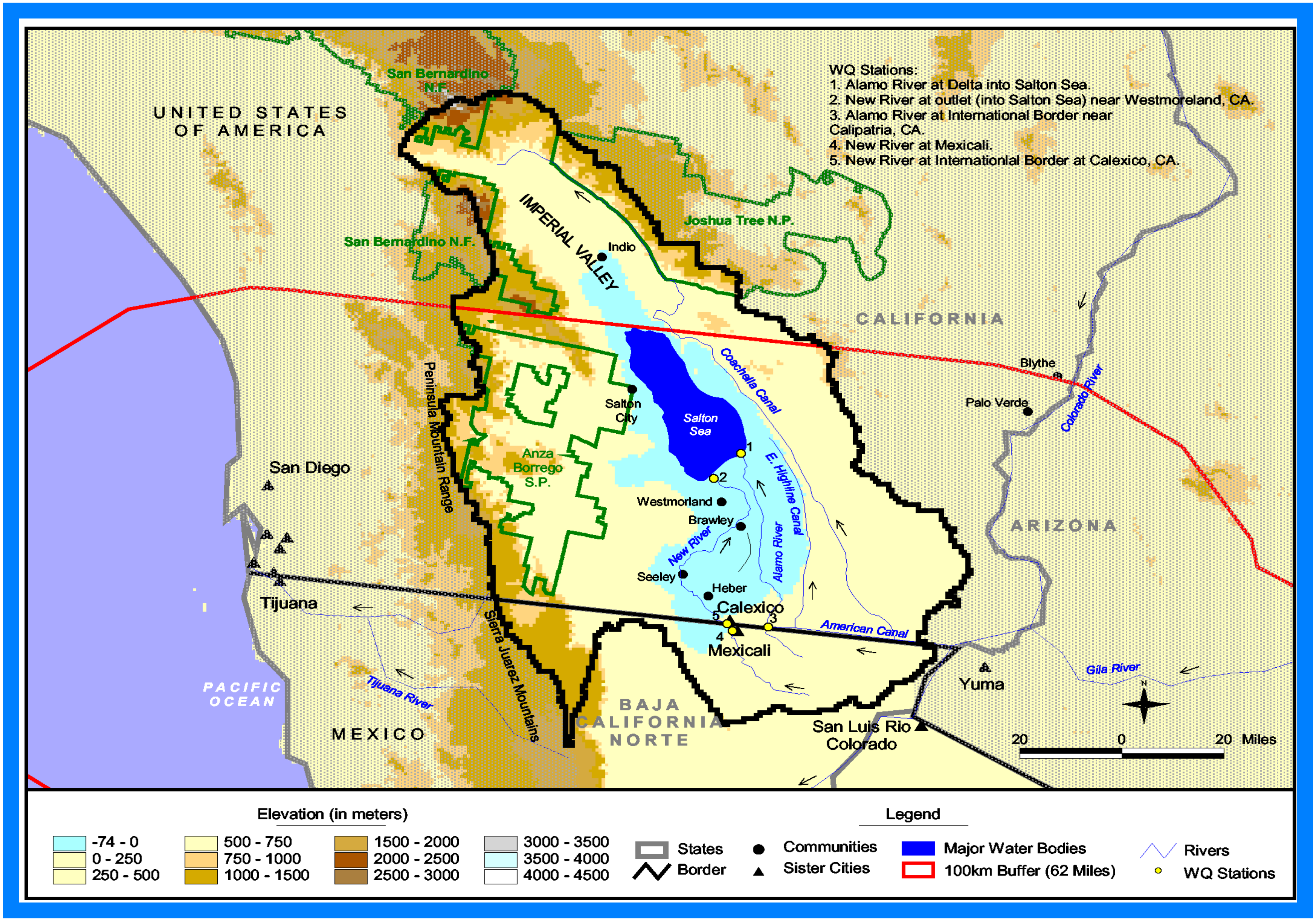

Figure 3-12. New River Basin Map with Water Quality Monitoring Stations

3.4.4 Public Health Conditions

While the New River Basin has some of the worst water quality conditions in the U.S., recent wastewater infrastructure investments in the basin, such as improvements to Mexicali's sanitary sewers, can be correlated with the 1988-1998 decline in Amebiasis, Shigellosis, and Hepatitis rates in Imperial County, California, as indicated in Table 3-4. No incidences were reported for Typhoid Fever.

Table 3-4.Reported Waterborne Diseases in the New River Basin (Incidences 100,000 People)

New River Basin	Amebiasis			Hepatitis a			Shigellosis			Typhoid Fever		
	1988	1998	% Chg.	1988	1998	% Chg.	1988	1998	% Chg.	1988	1998	% Chg.
U.S. Counties												
Imperial County	1	0	-100	19	16	-16	63.7	13.2	-79	0	0	0
Mexican Cities												
Mexicali	544	1910	251	34.2	154	350	10.6	18	70	20.6	107	419

Reference: Pan American Health Organization
website http://www.fep.paho.org/healthprofiles.

3.4.5 Existing Water and Wastewater Infrastructure

Blythe, California. Water supply is obtained from wells containing high concentrations of iron and manganese. The city provides for wastewater collection and treatment.

Brawley, California. The city operates a 1.7 mgd water treatment plant. The wastewater treatment plant consists of primary clarifiers, aerated lagoons and sludge digesters. EPA has provided funding for the water treatment plant.

Calexico, California. Water supply is obtained from the Colorado River and it is treated in a 10 mgd water treatment plant. Treatment of the wastewater is provided by a 2.1 mgd capacity plant. Both facilities are being expanded and EPA has provided funding for the water treatment plant.

Heber, California. The city has an existing water treatment plant with a capacity of 1.7 mgd. The water distribution system and wastewater collection system are being upgraded with funding participation from EPA.

Mexicali, Baja California. Water supply is obtained its from sources connected to the Colorado River. The water treatment plant serves 98 percent of the city. Wastewater collection and treatment is performed by stabilization ponds located in two service areas. The Mexicali I area is 96 percent sewered and Mexicali II is 80 percent sewered. The two systems treat almost 100 percent of the service area. EPA is participating in the funding of the improvements.

Palo Verde, California. Water is obtained from municipal wells. Wastewater is treated by individual septic tanks.

Salton, California. No information on water supply was provided. Wastewater is treated by stabilization/percolation ponds which are reported to produce high total dissolved solids in the groundwater.

Seeley, California. Water and wastewater infrastructure information was not provided.

Westmorland, California. Municipal water supply is obtained from Brawley, but there is no additional information about the distribution system. Wastewater is treated by stabilization ponds. EPA is participating in the funding of replacement of the existing wastewater treatment facility with an oxidation ditch facility.

3.5 Gulf of California Coastal Basin

3.5.1 Geography

The Gulf of California Coastal Basin, which has an area of approximately 5,800 square miles (15,000 sq. km) covering portions of the states of Baja California, Arizona, Sonora and Chihuahua as indicated on Fig. 3-13, consisting of horseshoe-shaped lowlands flanked by the Sierra Juarez and the Sierra San Pedro Martir mountain ranges to the west, and the Desierto de Altar (Sonoran Desert) and the Northwest Chihuahua highlands to the east. The Basin extends to the eastern part of Baja California and the north and northwest parts of Sonora. The principal communities in this basin are the cities of Caborca, Magdalena de Kino and Puerto Peñasco located in the State of Sonora in Mexico, Lukeville and Douglas in the State of Arizona.

3.5.2 Hydrology

The major surface waters in this basin are the lower Colorado River delta, and the Laguna Salada. From the north, the Colorado River flows into the basin through heavily urbanized areas near Yuma, Arizona, and San Luis Rio Colorado, Sonora and then through wetlands before flowing into the Gulf of California. At one time, the Colorado delta at the Gulf of California was a vast area of wetlands and salt flats that covered over 3,800 square miles (4,280 sq. km) and served as an important estuary. However, this delta region has been altered substantially by human activity. Most notably, upstream waters have been drawn off and diverted for municipal and industrial use, and for agricultural irrigation. Presently, there is little perennial flow in the lower Colorado River, most of the water that the delta receives coming from agricultural drainage from the U.S. and Mexico. In addition, smaller streams drain from the higher elevations to the east and west of the basin and then flow directly into the Gulf of California.

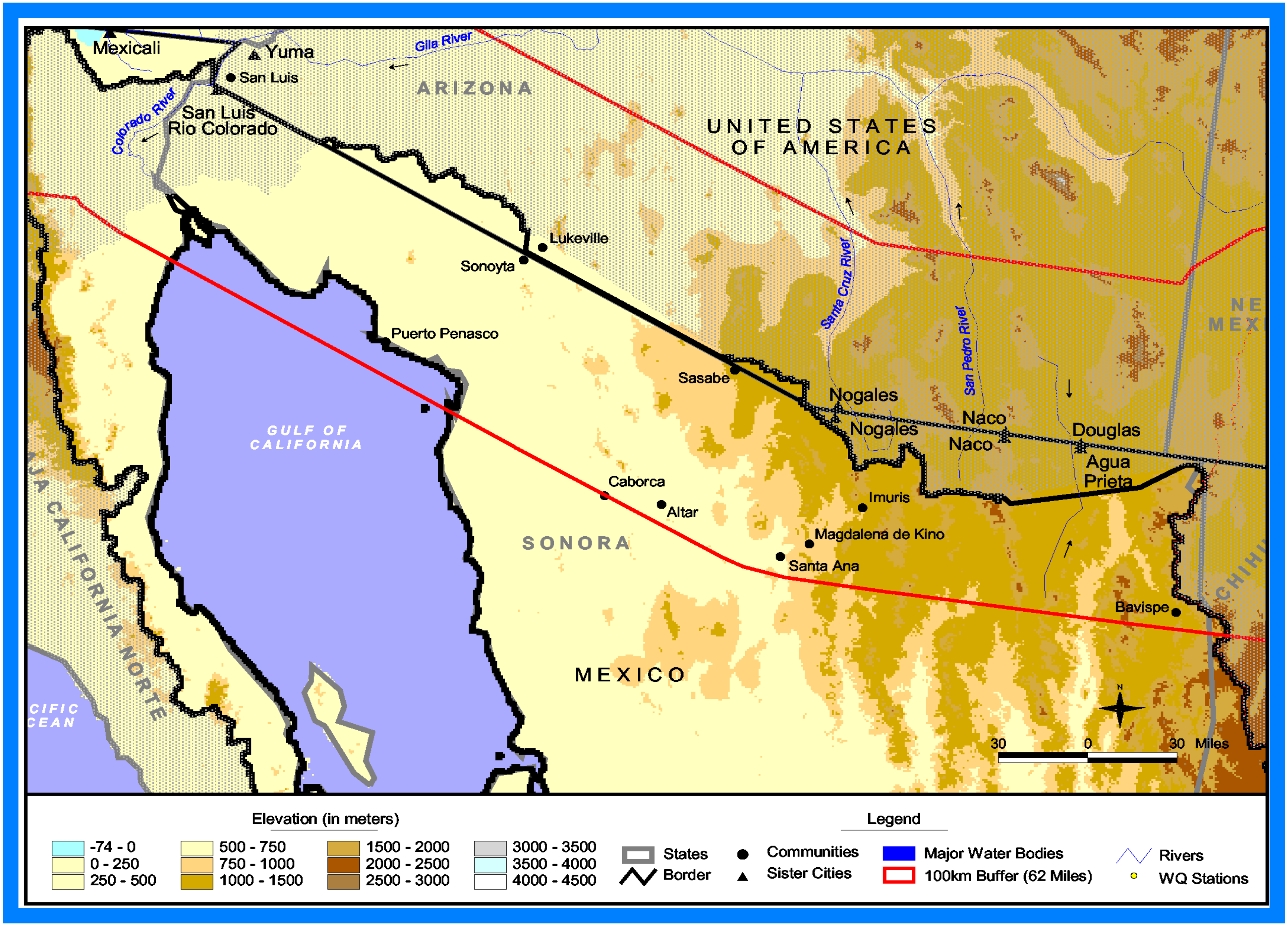

Figure 3-13. Gulf of California Coastal Basin Map.

3.5.3 Water Quality

Most of the water used for agricultural purposes flows back into the river, contributing to high salinity, solids, and nutrients from agricultural fertilizers. High salinity and solids levels in the Lower Colorado River are carried into the northern Gulf of California. No water quality data was available in this basin; no monitoring stations are shown on Fig. 3-13 Gulf of california Basin map.

3.5.4 Public Health Conditions

Public health data in the Gulf of California Basin within the State of Sonora, Mexico for the years 1999-2000 is included in Table 3-5. It encompassed the communities of Sonoyta, Puerto Peñasco, Caborca, Altar, Santa Ana, Magdalena de Kino, Imuris and Bavispe.

Table 3-5. Reported Waterborne Diseases in The Gulf of California Coastal Basin. (Incidences per 100,000 People)

Gulf of California Coastal Basin	Amebiasis			Hepatitis A			Shigellosis			Typhoid Fever		
Mexican States	**1999**	**2000**	**% Chg.**	**1999**	**2000**	**% Chg.**	**1999**	**2000**	**% Chg.**	**1999**	**2000**	**% Chg**
Sonora	23,708	22,747	-4	196	86	-56	44	68	55	1	3	200

Reference: Pan American Health Organization
website http://www.fep.paho.org/healthprofiles.

3.5.5 Existing Water and Wastewater Infrastructure

Altar, Sonora. Water supply is obtained from seven wells which provide service for 92 percent of the service area and the remaining population is served by water trucks. The wastewater collection and an oxidation pond treatment system serves for about 70 percent of the service area.

Bavispe, Sonora. Water supply is obtained from seven wells providing service for 96 percent of the service area. Wastewater collection is provided for about 77 percent of the service area with wastewater treatment provided by a stabilization pond.

Caborca, Sonora. Water supply serves 97 percent of the city from 8 foot deep wells and a water treatment plant with chlorination facilities. The wastewater collection system covers 92 percent of the city with the remaining population served by septic tanks and privies. Wastewater is treated in a stabilization pond.

Imuris, Sonora. Water supply is obtained from wells serving about 96 percent of the service area. Sewer lines have been installed in about 75 percent of the community, but only 40 percent are connected. Wastewater treatment is achieved by oxidation ponds.

Magdalena de Kino, Sonora. Water supply is obtained from wells near the Magdalena River, with a water treatment facility providing chlorination. The water distribution system serves 98 percent of the city. The wastewater collection system covers 91 percent of the city and wastewater is treated by a stabilization pond system.

Puerto Peñasco, Sonora. Water supply is obtained from two well fields some distance from the city with significant infiltration of sand into the transmission piping. Wastewater is collected from 82 percent of the city, and is treated in an oxidation pond system.

Santa Ana, Sonora. Water supply is obtained from wells and treated in a water treatment plant. Water distribution serves 81 percent and wastewater collection covers 54 percent of the city. No information on wastewater treatment systems has been reported.

Sásabe, Sonora. Water is obtained from wells. There is no municipal wastewater collection or treatment. Cesspools, septic tanks and privies are widely used.

Sonoyta, Sonora. Water supply is drawn from wells. A wastewater collection and treatment system includes a stabilization pond. No information for nearby Lukeville, Arizona is available.

3.6 Colorado River Basin

3.6.1 Geography

The Colorado River Basin runs from the Rocky Mountains of northern Colorado for 1,200 miles (1,920 km) to the delta at the Gulf of California as indicated on Fig. 3-14. The river basin drains approximately 246,000 square miles (637,000 sq. km) which covers the states of Wyoming, Utah, Colorado, Nevada, California, New Mexico and Arizona. The sister city pairs for this basin are: Yuma, Arizona/San Luis Rio Colorado, Sonora; Nogales, Arizona/Nogales, Sonora; Douglas, Arizona/Agua Prieta; Sonora; and Naco, Arizona/Naco, Sonora.

3.6.2 Hydrology

The Colorado River Basin major waterways are the Colorado River, the Gila River, the Santa Cruz River, and the San Pedro River. The Santa Cruz River flow, which drains an area of 8,200 square miles (21,240 sq. km), originates in Arizona, flows south across the border through the urban areas of Nogales, Sonora, and Nogales, Arizona, crossing back into the U.S. flows north into the Gila. The San Pedro River flows north across the international boundary before flowing into the Gila.

The lower Colorado River is the main water supply source for much of the southwestern U.S., as well as for northern Baja California and northwestern Sonora. Current agreements on water usage allot 8.5 million acre-feet per year (105 trillion liters per year) of water to the lower Colorado basin of the U.S., and 1.5 million acre-feet per year (18.5 trillion liters per year) to Mexico. Several dams and reservoirs are used for water storage significantly altering the natural river flow and reducing it to an ephemeral stream.

The lower Gila River flows east to west across southern Arizona. The entire Gila watershed drains approximately 57,900 square miles before joining the Colorado River near Yuma; 8200 square miles of this watershed is within the lower Colorado River area. Most of the Gila River is ephemeral and flows only when it rains or when water is released from the dams.

3.6.3 Water Quality

Water quality problems in the lower Colorado River Basin are due to an increase in sediment, salinity, and fecal coliform concentrations. High salinity and solids concentrations in the river and its tributaries are thought to be caused in part by water diversion and reuse. Some communities in the basin discharge untreated or partially treated wastewater into the Colorado River and produce high fecal coliform concentrations in the basin.

According to the State of Arizona National Water Quality Inventory Section 305(b) reports, fecal coliform concentrations have been found to exceed both U.S. and Mexican Standards at several water quality monitoring stations as indicated in Table 3-6 [Figure 3-14]. For example, fecal coliform concentrations in the East Nogales Wash, which flows into the Santa Cruz River in Nogales, Arizona, has been extremely high, exceeding the State of Arizona and Mexican standards of 200 colonies/100 ml. Fecal coliform contamination in the Wash is thought to result from periodic overflows of the sewer system, which is old and overloaded.

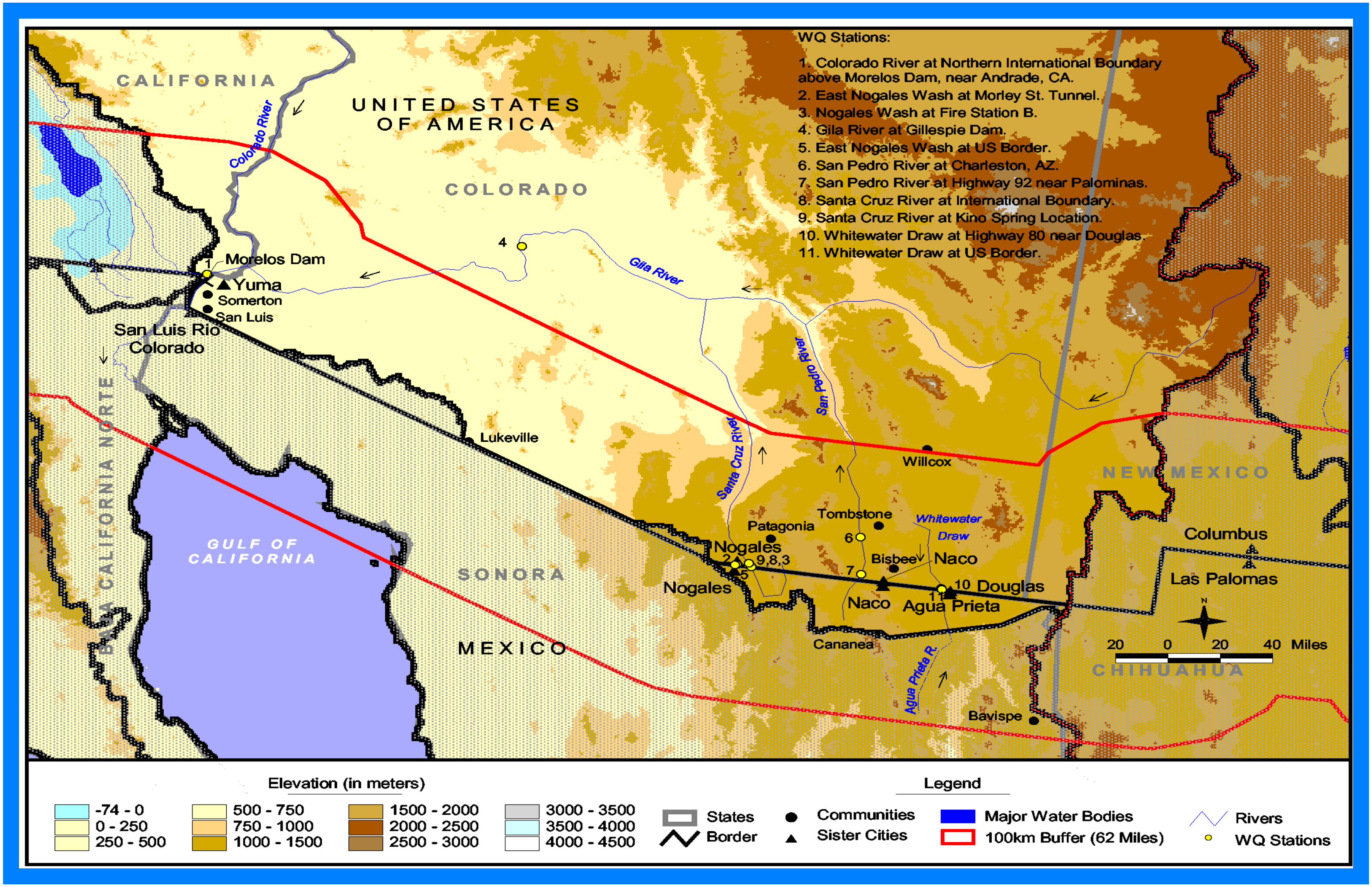

Figure 3-14. Colorado River Basin Map with Water Quality Monitoring Stations

Table 3-6. Comparison of Surface Water Quality Standards with Sampling Data For The Colorado River Basin

Station Number	Water Quality Monitoring Stations	U.S. Standards		Sampling Data		
		Fecal Coliform Colonies/ 100ml	Dissolved Oxygen mg/l	Fecal Coliform Colonies/100 ml Geometric Average	Dissolved Oxygen mg/l Geometric Average	Reporting Agencies and Time Frame
1	Colorado River at No. International Boundary above Morelos Dam	200	6.0	No Data	8.1	USBR 89-98
2	East Nogales Wash at Morley St	200	6.0	52,355	7.2	ADEQ 86-99
3	Nogales Wash at Fire Station	200	6.0	800	8.5	ADEQ 86-87
4	Gila River at Gillespie Dam	200	6.0	1296	76.8	USGS 88-97
5	East Nogales Wash at U.S. Border	200	6.0	No Data	No Data	ADEQ 86
6	San Pedro River at Charleston, AZ	200	6.0	688	89.0	USGS 88-93
7	San Pedro River at Highway 92 Palominas	200	6.0	323	8.1	ADEQ 88-99
8	Santa Cruz River at International Boundary	200	6.0	289	No Data	ADEQ 90-98
9	Santa Cruz River at Kino Spring location	200	6.0	No Data	6.5	ADEQ 86
10	Whitewater Draw at Highway 80	200	6.0	No Data	8.2	ADEQ 87-88
11	Whitewater Draw at U.S. Border	200	6.0	788	6.0	USGS 88-93

3.6.4 Public Health Conditions

Yuma, Pima, Santa Cruz and Cochise counties in Arizona had very high incidences of Hepatitis A, and Shigellosis. Table 3-7 contains incidences for this basin from 1988 to 1998. Hepatitis A decreased in Santa Cruz, Yuma and Cochise County , but increased in Pima County. Shigellosis decreased in all four counties, while there were no reported cases of Typhoid Fever.

In Mexico, gastrointestinal disease is prevalent in the Colorado River Basin, and it is one of the six leading causes of infant mortality in Nogales and Agua Prieta, Sonora. Public health data for San Luis Rio Colorado, Nogales, and Agua Prieta indicate that disease rates are higher there than in border counties in the U.S. Between 1988 and 1998, Hepatitis A rates for Nogales, Agua Prieta, and San Luis Rio Colorado decreased significantly. Amebiasis rates were also lower in all three cities. Typhoid fever rates decreased, but Shigellosis rates were not reported.

Table 3-7. Reported Waterborne Diseases in The Colorado River Basin (Incidences per 100,000 People)

Colorado River Basin	Amebiasis			Hepatitis A			Shigellosis			Typhoid Fever		
	1988	1998	% Chg.	1988	1998	% Chg.	1988	1998	% Chg.	1988	1998	% Chg.
U.S. Counties												
Yuma, AZ	0	0	0	40.2	25.7	-36	25.8	6.0	-77	0	0	0
Pima, AZ	0.5	0.6	20	22.5	29	29	41.3	24.2	-41	0	0	0
Santa Cruz, AZ	3.7	18.4	397	74.4	42.0	-44	26.1	23.6	-10	0	0	0
Cochise County, AZ	0	9.0	---	74.8	17.8	-76	11.4	3.6	-68	0	0	0
Mexican Cities												
Nogales, SN	956	757	-21	54.4	5.0	-91	No Data	1.0	---	2.8	1.0	-64
Agua Prieta, SN	956	63.0	-93	54.4	5.0	-91	No Data	1.0	---	2.8	0	-100
San Luis Colorado, SN	787	318	-60	28.4	10.0	-65	No Data	5.0	---	8.4	0	-100

Reference. Pan American Health Organization website http://www.fep.paho.org/healthprofiles.

3.6.5 Existing Water and Wastewater Infrastructure

Agua Prieta, Sonora. Water supply is obtained from two water supply wells providing service to 95 percent of the population. Wastewater collection coverage is about 60 percent which is treated in an oxidation pond.

.

Bisbee, Arizona. Water is obtained from two wells. There is a municipal wastewater collection system and treatment is by two stabilization pond systems and one trickling filter at three separate locations.

Cananea, Sonora. Water supply is obtained from fourteen wells in El Rio and Ojo de Agua basins, serving 98 percent of the community. The system had been maintained by a mining company until the beginning of 1999. Municipal wastewater collection system serves about 98 percent of the population. Wastewater is treated by a stabilization pond facility.

Douglas, Arizona. Water supply is provided by two reservoirs with a combined capacity of 5 mgd. The city provides wastewater collection and treatment at a 2 mgd activated sludge plant

Naco, Sonora. Water supply is obtained from two wells with provisions for chlorination. The water distribution system provides service to about 98 percent of the town. Wastewater that is collected from about 91 percent of the service area is treated in two stabilization ponds. EPA is participating in the financing for an upgrade of the two-pond system.

Nogales, Arizona. Water supply is obtained from wells, one of which has been impacted by volatile organic compounds. The water distribution system covers the entire service area. Wastewater collection and treatment serves 85 percent of the population. Wastewater treatment is provided by a package plant and by the Nogales International Wastewater Treatment Plant which is owned jointly by the city of Nogales and the U.S. Section of the IBWC who also operates the facility.

Nogales, Sonora. Water supply is drawn from wells which serve 85 percent of the population. Wastewater collection serves 85 percent of the population. Wastewater is treated at the Nogales International Wastewater Treatment Plant through an agreement with IBWC.

Patagonia, Arizona. Water supply is obtained from wells. The city provides wastewater treatment. EPA is participating in the funding of improvements to the wastewater treatment facility.

San Luis, Arizona. Water supply is obtained from one well. The city provides for wastewater collection and treatment.

San Luis Rio Colorado, Sonora. Water supply is drawn from 17 wells with provision for chlorination. The water distribution system serves 97 percent of the community and water trucks provide for the remainder. The city currently does not have a wastewater treatment facility. Wastewater collectors serving about 35 percent of the population discharge directly into the Colorado River.

Somerton, Arizona. Municipal water supply is obtained from wells with disinfection and is treated for iron and manganese. Wastewater treatment is provided by three stabilization ponds.

Tombstone, Arizona. Municipal water supply is obtained from a reservoir and two wells which is then conveyed by a 26-mile long aqueduct to the city. Wastewater is treated at an oxidation ditch facility.

Willcox, Arizona has a municipal wastewater treatment plant. No information was provided on water supply.

Yuma, Arizona. Municipal water supply is drawn from wells and chlorinated providing service to 99 percent of the population, with the remainder being served by water trucks. Wastewater treatment for the city of Winterhaven, California, and a U.S. Marine Corps base is provided by a 20 mgd city plant. There are also several private wastewater treatment facilities in the city.

3.7 Northwest Chihuahua Basin

3.7.1 Geography

The Northwest Chihuahua Basin is a high plateau that extends across the continental divide both in the U.S. and Mexico, covering about 32,000 square miles (83,000 sq. km) in the States of New Mexico, Chihuahua and Sonora. Cities in the basin include Columbus, New Mexico, and Las Palomas, Ascension, Janos, and Nuevo Casas Grandes in the State of Chihuahua.

3.7.2 Hydrology

The Northwest Chihuahua Basin, unlike the other major basins that span the U.S.-Mexico Border has no perennial streams flowing across it. Very few perennial streams flow within the basin, which is considered to be hydrologically landlocked. During wet weather, some transboundary streams such as Wamels Draw flow for short periods; nevertheless, they do not flow out of the basin before they dry out and completely disappear. The basin's only reliable water source is groundwater. The four major groundwater aquifers are the Mimbres, Animas Valley, Playas Valley, and Nutt-Hockett. Fig. 3-15 shows a typical watershed.

FIGURE 3-15 . Typical watershed basin showing ridges and valleys in the Northwest Chihuahua Basin.

3.7.3 Water Quality

Since this basin exhibits the dry to semi-dry conditions as shown in Fig. 3-16 and there are no continually available surface water sources, the quality of water existing in this basin is critically important. When rains create ephemeral flows in dry streambeds, accumulated pollutants are washed downstream and may enter the groundwater aquifer. Because groundwater is the main water source in the basin, groundwater pollution is a major concern. Also, groundwater pumping currently exceeds the estimated replenishment rate. No water quality sampling has been done in this basin; so no monitoring stations are shown on Fig. 3-17, Northwest Chihuahua Basin map.

FIGURE 3-16. Typical semi-desert conditions in NW Chihuahua basin.

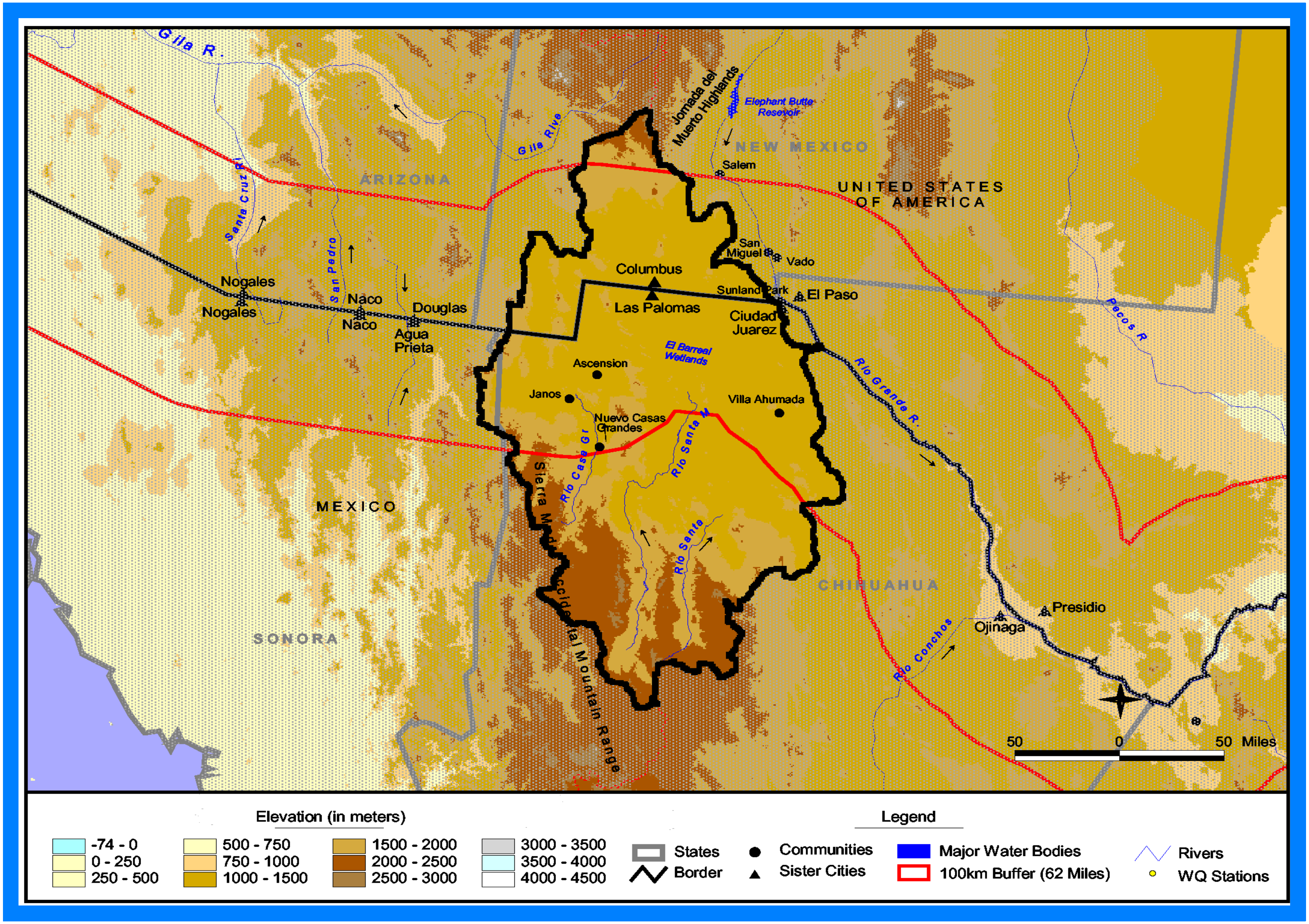

Figure 3-17. Northwest Chihuahua Basin Map.

3.7.4 Public Health Conditions

Available public health data for Luna, Doña Ana, and Hidalgo Counties in New Mexico indicate no reportable cases of Amebiasis, Hepatitis A, Shigellosis or Typhoid Fever in 1998 as indicated on Table 3-8. There were some reported cases of these diseases in 1988. No available data on incidence rates exist for the community of Las Palomas, Chihuahua.

Table 3-8. Reported Waterborne Diseases in the Northwest Chihuahua Basin (Incidences per 100,000 People)

Northwest Chihuahua Basin	Amebiasis			Hepatitis A			Shigellosis			Typhoid Fever		
	1988	1998	% Chg.	1988	1998	% Chg.	1988	1998	% Chg.	1988	1998	% Chg.
U.S. Counties												
Luna	5.7	0	-100	0	0	0	17.0	0	-100	0	0	0
Doña Ana	0	0	0	15.4	0	-100	30.8	0	-100	0.7	0	-100
Hidalgo	0	0	0	0	0	0	0	0	0	0	0	0
Mexican Cities												
Las Palomas	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data

Reference: Pan American Health Organization
website http://www.fep.paho.org/healthprofiles.

3.7.5 Existing Water and Wastewater Infrastructure

Ascension, Chihuahua. Water supply is obtained from five wells, serving about 83 percent of the community. Wastewater is collected from 44 percent of the community and discharged to an unlined treatment pond facility.

Columbus, New Mexico. Water supply is obtained from wells that serve the entire community. Wastewater treatment is provided by oxidation ponds serving the entire population.

Janos, Chihuahua. Water supply is obtained from three wells, only one of which is fully operational. Wastewater collection serves 25 percent of the community with an untreated discharge to the San Pedro River.

Nuevo Casas Grandes, Chihuahua. Water supply is obtained from wells serving about 97 percent of the community. Wastewater is collected from 41 percent of the population; no wastewater treatment available.

Las Palomas, Chihuahua. Water supply is obtained from wells with a high fluoride content. Municipal wastewater collection serves about 25 percent of the population; no wastewater treatment is provided.

Villa Ahumada, Chihuahua. Water supply serves about 98 percent of the population. Wastewater collection system serves about 38 percent of the community; no wastewater treatment is provided.

3.8 Rio Grande Basin

3.8.1 Geography

The Rio Grande Basin extends 1,896 miles (3,051 km) from the river's headwaters in the San Juan Mountains of southern Colorado to near its mouth in the Gulf of Mexico. (The Gulf of Mexico Coastal Basin covers the delta of the Rio Grande immediately adjacent to the Gulf of Mexico). The Rio Grande drains an area of approximately 182,215 square miles (471,937 sq. km) in the three U.S. States of Colorado, New Mexico and Texas and the five Mexican States of Chihuahua, Coahuila, Durango, Nuevo Leon and Tamaulipas. Mountain ranges dominate the landscape, and include the Sierra de la Ensenada and Huachuca Ranges. Major cities along the lower Rio Grande, which is a part of the U.S.-Mexico binational boundary include five sister city pairs, which are El Paso, TX/Ciudad Juarez,CH, Presidio,TX/Ojinaga, CH, Del Rio/Ciudad Acuña,CO, Eagle Pass,TX/Piedras Negras,CO and Laredo,TX/Nuevo Laredo,TM.

3.8.2 Hydrology

The primary water courses in the basin are the Rio Grande and its tributaries, including the Rios Conchos, Salado, and San Rodrigo in Mexico, and the Pecos and Devil's Rivers in Texas. On the main stream are the Amistad and the Falcon Reservoirs. The Rio Grande, which in Mexico is known as the Rio Bravo, defines the international boundary from El Paso, Texas/Ciudad Juaréz, Chihuahua, to its delta on the Gulf of Mexico.

Most flows in the upper Rio Grande Basin originate from precipitation in the Rocky Mountains. Flow contributions into the Rio Grande are from the Guadalupe, Davis, Santiago, and Sierra Madre Occidental mountain ranges of western Texas and northeast Chihuahua and Coahuila. A hydrographic feature of the region is the extent of control on the natural flow of the river including dams, reservoirs, canals and diversions for water supply and flood control. The water control structures have altered the river flow in the basin, and have made flow in the lower Rio Grande dependent on controlled releases and "return flows" back to the river from agricultural and other commercial water uses.

3.8.3 Water Quality

The Rio Grande is impacted by discharges from communities and industries along its banks and tributaries and by agricultural runoff as shown on Fig. 3-18. U.S. Colonia communities are located close to the river and to a public water supply or wastewater systems.

FIGURE 3-18. Sewage discharge to a waterway containing foaming detergents near Rio Grande.

Fecal coliform bacteria concentrations are a concern in all of the major urban centers. For instance, fecal coliform concentrations averaged 1,518 colonies/100 ml below Laredo/Nuevo Laredo, exceeding both Texas water quality standards and Mexican Standards of 200 colonies/100 ml for contact recreation water. As indicated on Table 3-9 most of the water quality monitoring stations shown on Figs. 3-19 and 3-20 met the minimum dissolved oxygen requirement of 5 mg/l.

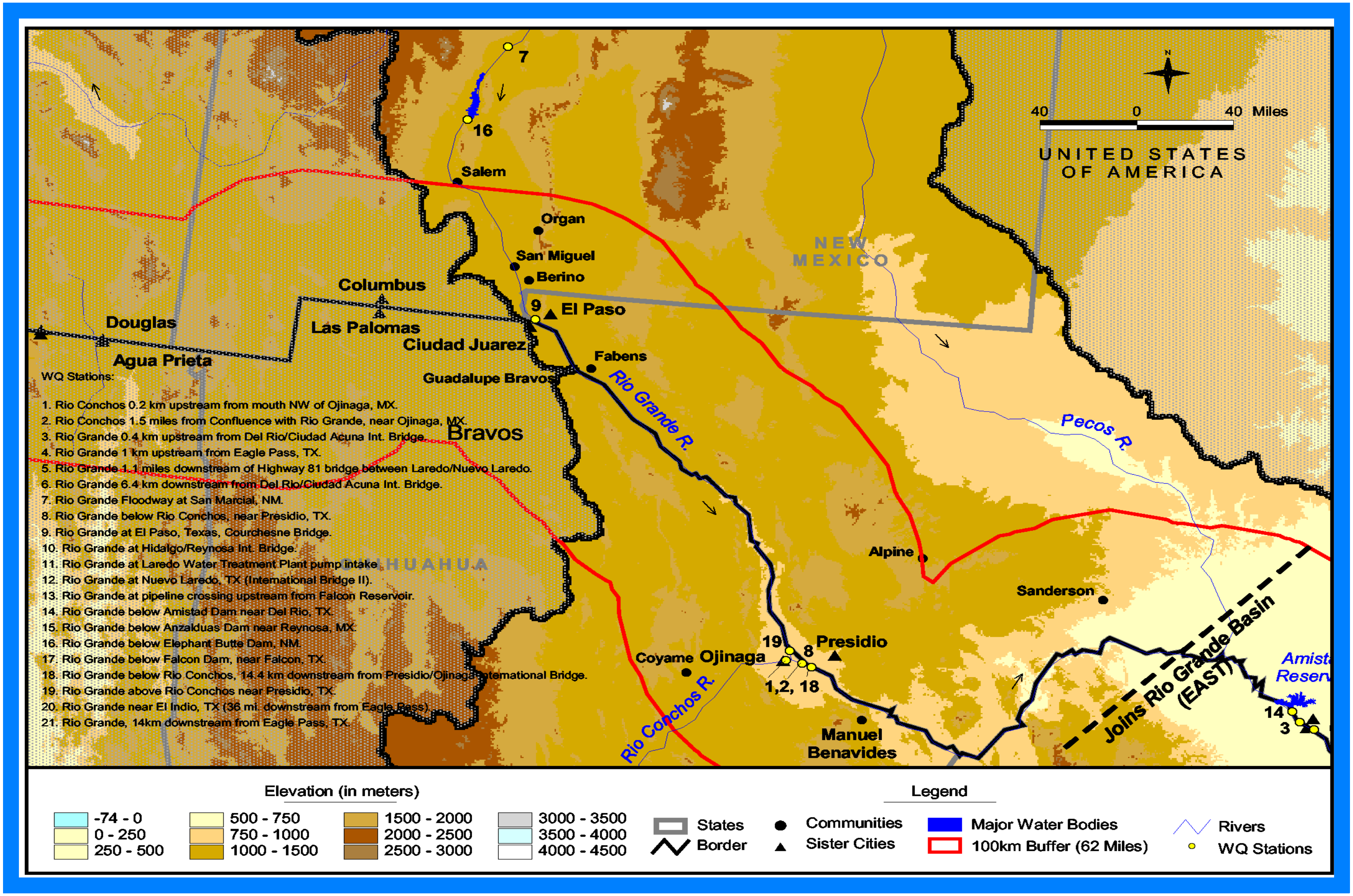

Figure 3-19. Rio Grande Basin Map with Water Quality Monitoring Stations (Northwest Section)

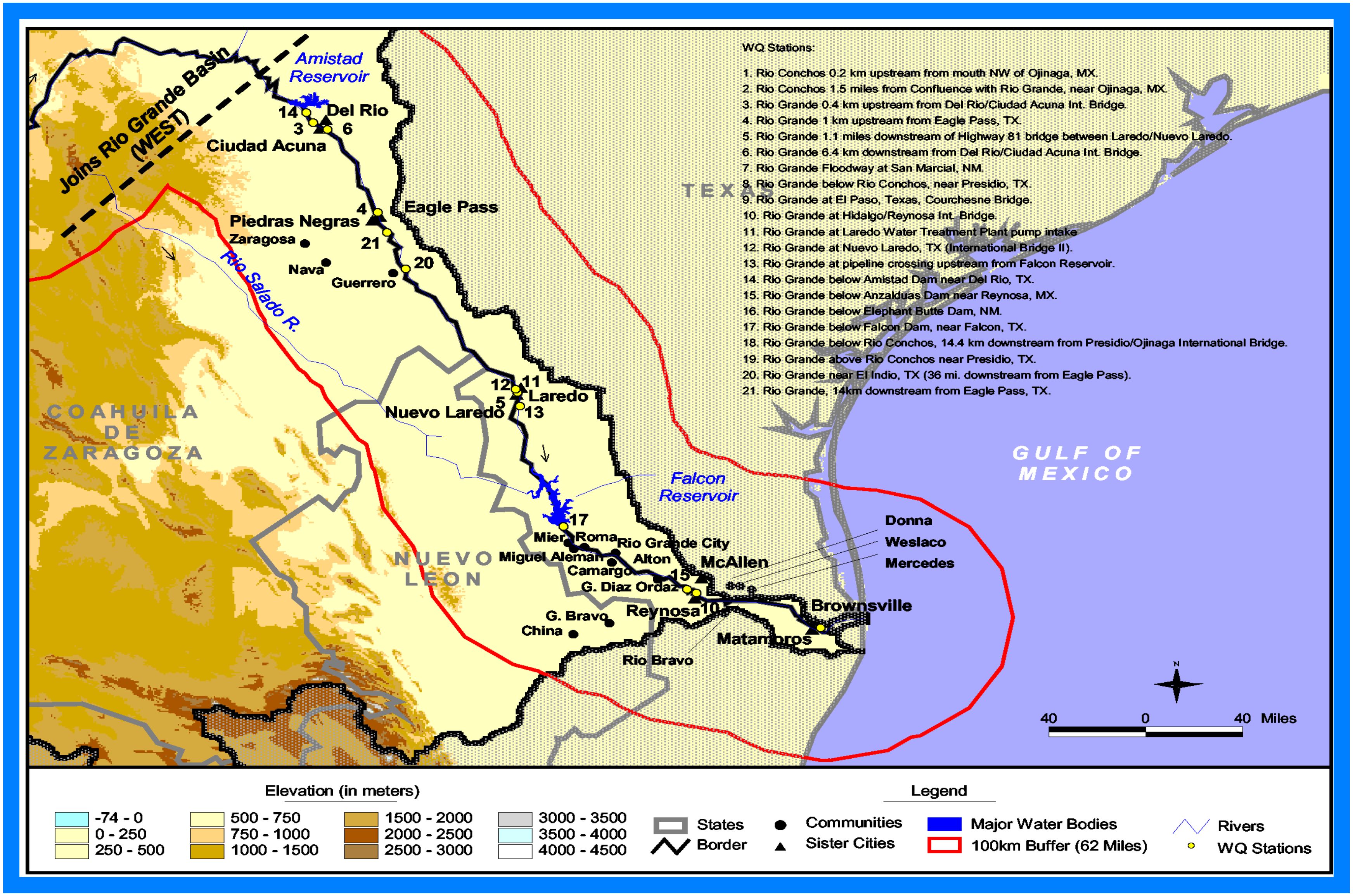

Figure 3-20. Rio Grande Basin Map with Water Quality Monitoring Stations (Southeast Section)

Table 3-9 Comparison of Surface Water Quality Standards with Sampling Data for the Rio Grande Basin

Station Numbers	Water Quality Monitoring Stations	U.S. Standards		Sampling Data		
		Fecal Coliform Colonies/ 100ml	Dissolved Oxygen mg/l	Fecal Coliform Colonies /100ml Geometric Average	Dissolved Oxygen mg/l Geometric Average	Reporting Agency and Time Frame
1	Rio Conchos 0.2 Km upstream from mouth NW of Ojinaga, Mexico	200	5.0	No Data	7.6	IBWC 92
2	Rio Conchos, 1.5 miles from confluence with Rio Grande, near Ojinaga, Mexico	200	5.0	No Data	ND	USGS
3	Rio Grande 0.4 km upstream from Del Rio/Ciudad Acuña International bridge	200	5.0	No Data	8.2	TNRCC 91-92
4	Rio Grande 1 km upstream of Eagle Pass	200	5.0	705	8.2	IBWC 93-98
5	Rio Grande 1.1 miles downstream of Highway 81 bridge between Laredo/Nuevo Laredo	200	5.0	1518	11.3	TNRCC 89-94
6	Rio Grande 6.4 Km below Del Rio/Ciudad Acuña International bridge	200	5.0	330	7.7	TNRCC 88-92
7	Rio Grande Floodway at San Marcia, NM	1000	6.0	576	9.2	USGS and NM WRD
8	Rio Grande below Rio Conchos near Presidio,TX.	200	5.0	No Data	11.7	TNRCC 92-98
9	Rio Grande at El Paso, TX Courchesne Bridge	200	5.0	No Data	8.0	USGS 92
11	Rio Grande at Laredo Water Treatment Plant pump intake	200	5.0	105	11.9	TNRCC 88-97

Table 3-9 Comparison of Surface Water Quality Standards with Sampling Data for the Rio Grande Basin

Station Numbers	Water Quality Monitoring Stations	U.S. Standards		Sampling Data		
		Fecal Coliform Colonies/ 100ml	**Dissolved Oxygen mg/l**	**Fecal Coliform Colonies /100ml Geometric Average**	**Dissolved Oxygen mg/l Geometric Average**	**Reporting Agency and Time Frame**
12	Rio Grande at Nuevo Laredo at International Bridge II	200	3.0	690	8.7	USGS 88
13	Rio Grande at pipeline crossing upstream from Falcon Reservoir	200	5.0	10,529.00	7.3	TNRCC USGS 88-98
14	Rio Grande below Amistad Dam near Del Rio, TX	200	5.0	No Data	6.3	USGS 93
15	Rio Grande below Anzalduas dam near Reynosa, MX	200	5.0	No Data	No Data	USGS 93
16	Rio Grande below Elephant Butte Dam, NM	1000	5.0	No Data	8.9	USGS 92 NMWRD
17	Rio Grande below Falcon dam Near Falcon, TX	200	5.0	No Data	69.0	USGS 99
18	Rio Grande below Rio Conchos, 14.4 km downstream of Presidio/Ojinaga International Bridge	200	5.0	235	No Data	TNRCC 88-98
19	Rio Grande below Rio Conchos near Presidio, TX	200	5.0	No Data	No Data	USGS
20	Rio Grande near El India, TX (36 miles down from Eagle Pass)	200	5.0	94	8.2	USGS 88-93
21	Rio Grande 14 Km down of Eagle Pass	200	5.0	623	7.9	TNRCC 88-9

Note: No water quality monitoring station 10 shown . Monitoring station is shown in the Gulf Coastal Basin

3.8.4 Public Health Conditions

The shared water resources of the Rio Grande and the migration of people across the U.S.-Mexico Border for personal or business purposes represent a major mode of cross-border disease transmission. The public health conditions in the Texas counties bordering the Rio Grande in 1988 and 1998 are indicated on Table 3-10.

Amebiasis rates on the U.S. side of the border have been almost insignificant over a 10 year period, while the Mexican side has increased at an astonishing rate.

Hepatitis A is also a problem in the border area. On the U.S. side of the border, incidence rates have generally increased over the 10 year period; however, on the Mexican side it has decreased. The 1988 rate of Hepatitis A in the border area was about three times the average U.S. rate.

Shigellosis has increased in the majority of the U.S. and Mexico border communities. It is interesting to note that El Paso had an increase of 63 percent and Ciudad Juaréz a 900 percent increase over a 10 year period.

Typhoid Fever in U.S. border communities has been almost eradicated, but Mexico border communities still have a higher incidence rate.

Table 3-10 Reported Waterborne Diseases in the Rio Grande Basin (Incidences per 100,000 people).

Rio Grande Basin	Amebiasis			Hepatitis A			Shigellosis			Typhoid Fever		
US Counties	**1988**	**1998**	**% Chg.**	**1988**	**1998**	**% Chg.**	**1988**	**1998**	**% Chg.**	**1988**	**1998**	**% Chg.**
Brewster	0	0	0	23.1	123.7	436	0	11.2	---	0	0	0
El Paso	1.2	0	-92	43.2	18.2	-58	10.7	17.4	63	0	0	0
Hidalgo	0.8	0.2	-75	2.5	69.9	2696	9.9	41.9	323	0.2	0	-100
Hudspeth	0	0	0	0	30.8	---	0	30.8	---	0	0	0
Jeff Davis	0	0	0	53.4	0	-100	0	0	0	0	0	0
Kinney	0	0	0	0	0	0	34.8	0	-100	0	0	0
Maverick	2.8	0	-100	219.0	4.2	-98	16.9	22.9	36	0	0	0
Starr	2.6	1.8	-31	36.3	42.9	18	2.6	7.2	177	0	0	0
Terrell	0	0	0	0	0	0	0	0	0	0	0	0
Val Verde	0	0	0	2.5	11.4	356	2.5	45.6	1724	0	0	0
Webb	0	0	0	43.5	13.3	-69	29.2	8.5	-71	0.8	0	-100
Willacy	0	0	0	32.9	30.6	-7	0	30.6	---	0	0	0
Zapata	0	0	0	11.1	87	684	0	34.8	---	0	0	0
Mexican Cities												
Ciudad Juárez	315	1711	443	38.3	34	-11	1.5	15	900	1.5	225	14900
Ciudad Acuña	1478	2858	93	25.5	10	-61	4.9	36.0	635	9.7	9	-7
Piedras Negras	1318	1805	37	90.9	19	-79	0	78	---	86.7	35	-60
Sabinas Hidalgo	3091	No Data	---	93.7	No Data	---	87.8	No Data	---	70.3	No Data	No Data
Nuevo Laredo	1099	1248	14	55.7	44	-21	10.3	7.0	-32	18.7	337	1702
Reynosa	1370	3798	177	143	220	54	0	50	---	278.0	237	-15

Reference: Pan American Health Organization

website http://www.fep.paho.org/healthprofiles.

3.8.5 Existing Water and Wastewater Infrastructure

Alpine, Texas. Water supply is obtained from wells serving the entire population. The community has an existing wastewater treatment plant.

Alton, Texas. A municipal water, wastewater treatment, and a collection system serve the community. Improvements are being made with EPA funds.

Camargo, Tamaulipas. Water supply is obtained from the Rio Grande without treatment and from two wells with chlorination to supply over 96 percent of the city. Wastewater collection covers 60 percent of the city, but only 35 percent of the population is connected. Wastewater treatment is provided by a stabilization pond.

China/General Bravo, Nuevo Leon. Water supply is obtained from a surface impoundment with treatment; 75 percent of China and 96 percent of General Bravo are served. Wastewater collection serves 20 percent of China, but without treatment.

Ciudad Acuña, Coahuila. Water supply is obtained from the Rio Grande and treated. About 82 percent of the population is served by a water distribution system and the remainder of the population is served by water trucks. Wastewater is treated by an activated sludge system. Wastewater is collected from 60 percent of the city, the remainder served by septic tanks or cesspool systems. EPA has participated in funding these facilities and a system-needs study. Figs. 3-21 and 3-22 show the wastewater collection system under construction.

Figure 3-21. Sewer Installation in Ciudad Acuña, Coahuila, Mexico.

Figure 3-22 Sewer Inspection in Ciudad Acuña, Coahuila , Mexico

Ciudad Juárez, Chihuahua. Water supply is obtained from wells which supply the entire population. Two wastewater treatment plants, named North and South, have been completed and are in operation. Figs. 3-23 and 3-24 show portions of the wastewater treatment plant under construction. EPA has participated in funding of improvements to the wastewater collection system and one pump station in coordination with construction of the treatment plants.

Figure 3-23. Pump Station under construction at Ciudad Juárez, Mexico.

Figure 3-24. Wastewater Treatment Plant at Ciudad Juárez, Chihuahua, Mexico.

Coyame, Chihuahua. Water supply is obtained from wells which serve about 90 percent of the community. Wastewater collection serves about 25 percent of the population; however, no treatment is provided.

Del Rio, Texas. Water supply is obtained from the San Felipe Springs. The city is served by a wastewater collection and treatment system. EPA has participated in the funding of treatment for the water supply and improvements to storage and distribution facilities.

Donna, Texas. Water supply is obtained from the Rio Grande and treated in a 4.5 mgd water treatment plant. The entire population and 20 Colonias are served. Wastewater treatment is provided in a 2.7 mgd activated sludge plant. EPA has participated in funding replacement of the city water treatment plant, as well as water supply and wastewater collection for the Colonias. Fig. 3-25 shows a colonia housing along the border .

Figure 3-25. Colonia housing showing privy in the background.

Eagle Pass, Texas. The city has a water supply system and a request has been received from the nearby Colonia of Pueblo Nuevo for extending water service, wastewater collection and treatment.

El Paso, Texas. Water supply is obtained from several well fields and from the Rio Grande. The surface water is treated in a water treatment facility which serves the entire population, with additional treatment in the planning stage. Wastewater treatment is provided by four plants that serve the entire community, as well as Colonias located adjacent to the city. EPA has participated in the funding of planning and construction for water supply improvements for the city and the Colonias.

Fabens, Texas. Water supply is obtained from wells with a high iron and manganese content. No information was provided on wastewater treatment.

Gustavo Díaz Ordaz, Tamaulipas. Water is supplied to 97 percent of the city, the remainder of the population relying on shallow wells or water trucks for drinking water needs. Wastewater is collected from 30 percent of the city and treated in a stabilization pond, with the remainder using septic tanks and latrines.

Guadalupe Bravos, Chihuahua. Water supply is obtained from two wells, with a high total dissolved solids content. About 50 percent of the population is served by a wastewater collection system; however, no wastewater treatment is provided.

Laredo, Texas. Water supply is obtained from the Rio Grande and treated in two water treatment plants. Water is distributed to the entire city except to the Colonias, which are served by water trucks. Wastewater treatment is provided by five plants. A wastewater collection system serves the entire community. Colonias are served by septic tanks. Typical Colonias are shown in Figs. 3-26 and 3-27.

Figure 3-26. Colonia Housing along the border.

Figure 3-27 Typical U.S. Colonia..

Manuel Benavides, Chihuahua. Water distribution is to about 65 percent of the population. About 25 percent of the population is served by a wastewater collection system, but without treatment.

McAllen, Texas. Water supply is obtained from the Rio Grande and the entire population is served by the distribution system. Wastewater treatment is performed at two activated sludge plants having a total capacity of 16 mgd and a wastewater collection system that covers about 90 percent of the city.

Mercedes, Texas. Water supply is obtained from a well and the Rio Grande and treated. Water is distributed to the entire city. Wastewater treatment is provided by an activated sludge plant; wastewater collection covers 98 percent of the city. EPA has participated in the funding of water supply and wastewater system improvements.

Mier, Tamaulipas. Water supply is drawn from Rio Grande and treated. Water is distributed to 90 percent of the community. Wastewater treatment is provided by an activated sludge plant. Colonias outside the city are not served by the water and wastewater treatment systems.

Miguel Alemán, Tamaulipas. Water is obtained from the Rio Grande and treated with distribution to 90 percent of the service area. Wastewater is collected from 80 percent of the population and treated by stabilization ponds.

Nava, Coahuila. Water supply is obtained from twenty-one wells and distributed to 93 percent of the population. Wastewater is collected from about 27 percent of the service area, including Estación Rio Escondido and La Sauceda, but with no treatment.

Nueva Ciudad Guerrero, Tamaulipas. Water supply is drawn from Falcon Reservoir and distributed to about 90 percent of the population. Wastewater is collected from about 61 percent of the population and the treatment system is an Imhoff tank, which is currently out of service.

Nuevo Laredo, Tamaulipas. Water supply is obtained from the Rio Grande, treated by two plants and distributed to about 90 percent of the city. Wastewater is collected from about 85 percent of the population and treated by an activated sludge plant. EPA has participated in the funding of facilities and a system-needs study.

Ojinaga, Chihuahua. Water supply is obtained from six wells and distributed to 98 percent of the population. Wastewater is collected from 55 per cent of the population and treated in an oxidation pond facility.

Piedras Negras, Coahuila. Water supply is obtained from the Rio Grande and treated. Wastewater is collected from the entire city and treatment is provided in a stabilization pond. EPA has participated in the funding of facilities and a system-needs study.

Presidio, Texas. The city has a municipal water supply and distribution system. Wastewater is collected and pumped to stabilization ponds for treatment.

Reynosa, Tamaulipas. Water supply is obtained from the Rio Grande, treated by two water treatment plants and distributed to approximately 93 percent of the city. Wastewater is collected from 70 percent of the population and treated, but there are two untreated discharge points. EPA has participated in the funding of some facilities and a needs study, as well as the construction of improvements to the wastewater treatment and collection system.

Rio Bravo, Tamaulipas. Water is obtained from the Rio Grande and treated. Distribution is to about 95 percent of the community. Wastewater collection serves 50 percent of the population and treatment is provided by an activated sludge plant. Nearby Colonias are not served.

Rio Grande, Texas. The city has a municipal water supply, treatment and distribution system, as well as a wastewater collection and treatment system.

Roma, Texas. Water supply is drawn from the Rio Grande, with 1.5 mgd of treatment capacity. Wastewater is collected from about 25 percent of the population and treated at an activated sludge plant. EPA is participating in funding of a new wastewater treatment plant and of water distribution and wastewater collection for Colonias.

Sanderson, Texas. Water is supplied to the entire community. Wastewater is treated in septic tanks and cesspools.

Weslaco, Texas. No information was provided on the water supply. Wastewater treatment exists, but further information was not provided.

Zaragoza, Coahuila. Water supply is obtained from eight wells, treated and distributed to 86 percent of the population. There is no wastewater treatment, although collection covers 75 percent of the community and 41 percent is served.

3.9 Gulf of Mexico Coastal Basin

3.9.1 Geography

The Gulf of Mexico Coastal basin is defined as the delta area between Brownsville and Matamoros and the coastline along these two cities which drains directly into the Gulf of Mexico.

The major cities are Matamoros and Valle Hermoso in Tamaulipas, Mexico, and Brownsville, Texas, as shown in Fig 3-28.

3.92 Hydrology

The Rio Grande in the Gulf of Mexico Coastal Basin widens into a flood plain area near the sister cities of Brownsville, Texas, and Matamoros, Tamaulipas. The river flows through wetlands, salt marshes and open waters until it finally reaches the Laguna Madre and drains into the Gulf of Mexico

3.9.3 Water Quality

Water quality in the Gulf of Mexico Coastal Basin is impacted by increasing population growth, urbanization, and industrialization, which will place a high demand on the water resources available in the basin.

High concentrations of solids and other substances are related to industrial pollution; bacteriological contamination is due to raw or partially treated sewage discharges. As indicated in Table 3-11 [Figure 3-28], fecal coliform concentrations in Brownsville below El Jardin Pumping Station exceeded Texas water quality criteria of 200 colonies/100 ml for contact recreation, as well as Mexican standards.

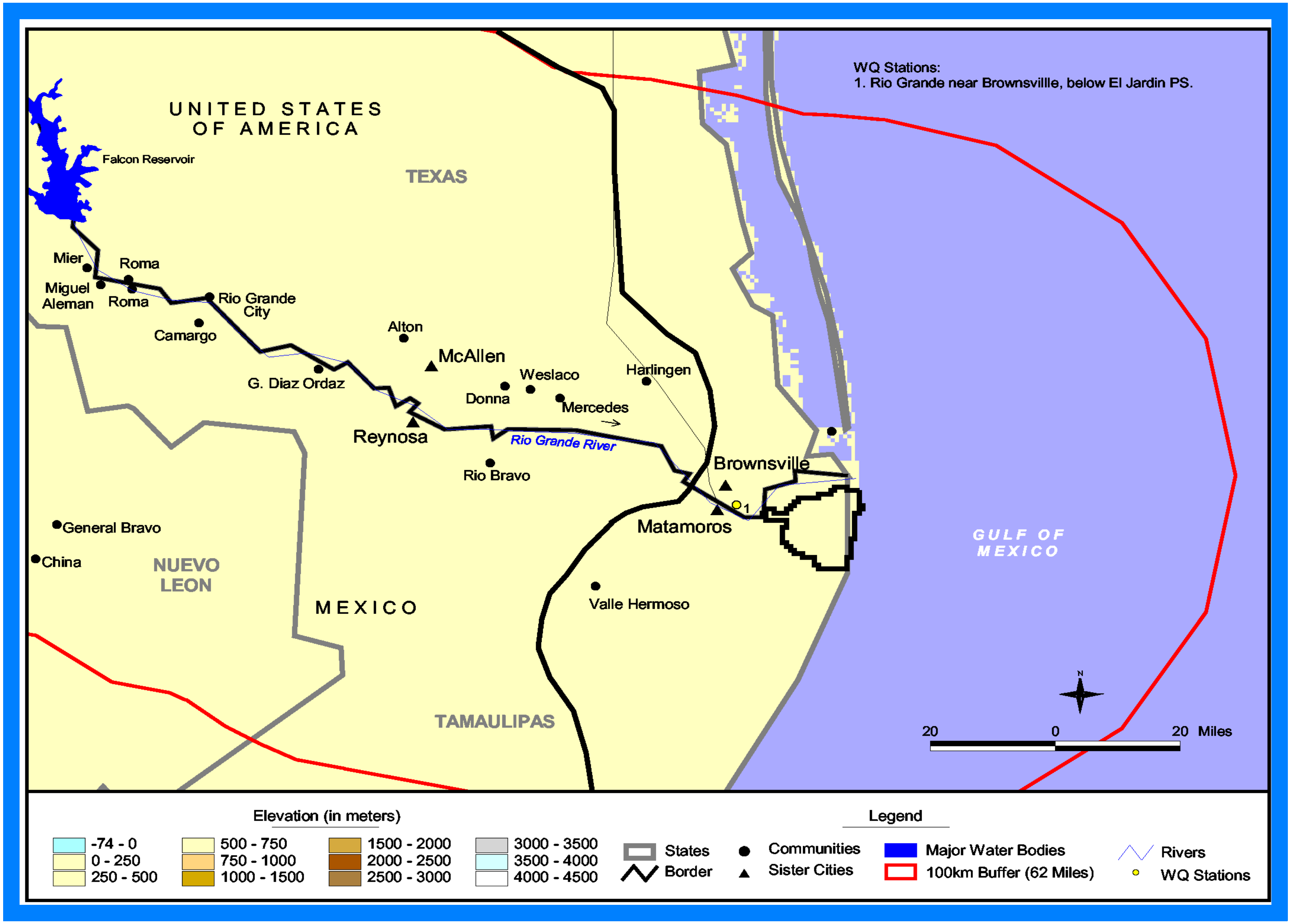

FIGURE 3.27. Gulf of Mexico Coastal Basin Map With Water Quality Monitoring Stations

Table 3-11 Comparison of Surface Water Quality Standards with Sampling Data for Gulf of Mexico Coastal Basin.

Station Numbers	Water Quality Monitoring Stations	U.S. Standard		Sampling Data		
		Fecal Coliform colonies/ 100ml	Dissolved Oxygen mg/l	Fecal Coliform colonies/ 100ml Geometric Average	Dissolved Oxygen mg/l Geometric Average	Reporting Agencies and Time Frame
1	Rio Grande near Brownsville below Jardin Pumping Station	200	5.0	1574	7.70	USGS 88-95

3.9.4 Public Health Conditions

Incidence rates in 1988 and 1998 for Amebiasis, Hepatitis, Shigellosis and Typhoid Fever for Cameron County, Texas and Matamoros, Tamaulipas are indicated on Table 3-12 below.

Table 3-12 Reported Waterborne Diseases in the Gulf of Mexico Coastal Basin (Incidences per 100,000 people)

Gulf of Mexico Coastal Basin	Amebiasis			Hepatitis A			Shigellosis			Typhoid Fever		
	1988	**1998**	**% Chg.**	**1988**	**1998**	**% Chg.**	**1988**	**1998**	**% Chg.**	**1988**	**1998**	**% Chg.**
U.S. Counties												
Cameron County,TX	14.2	6.1	-57	22.8	66.5	1916	19.7	41	108	**0.8**	**0.6**	-25
Mexican Cities												
Matamoros, TM	1029	2477	141	50	332	564	16.1	24	49	22	40	82

Reference: Pan American Health Organization
website http://www.fep.paho.org/healthprofiles.

3.9.5 Existing Water and Wastewater Infrastructure

Brownsville, Texas. Water supply is obtained from the Rio Grande, treated in two water treatment plants and distributed to the entire city. Wastewater is collected and treated by two activated sludge plants with a total capacity of 22.8 mgd. EPA has participated in the funding of planning for water supply improvements.

Matamoros, Tamaulipas. Water supply is obtained from the Rio Grande, treated in four water treatment plants with about 32 mgd total capacity and distributed to 90 percent of the city. Wastewater is conveyed untreated in open channels through the Laguna Madre to the Gulf of Mexico. Collector sewers serve 85 percent of the city. EPA has participated in funding some facilities and system-needs study.

Valle Hermoso, Tamaulipas. Water supply is obtained from the Rio Grande, treated and distributed to approximately 98 percent of the city. Wastewater is conveyed by open channels through agricultural fields and the Laguna Madre to the Gulf of Mexico. Wastewater is collected from 55 percent of the city, but no treatment is provided. The remaining wastewater is treated by septic tanks or latrines.